PATENT SPECIFICATION 1,145,752

DRAWINGS ATTACHED.

1,145,752

Date of filing Complete Specification: 11 May, 1966.

Application Date: 11 May, 1965. No. 19788/65.

Complete Specification Published: 19 March, 1969.

Index at Acceptance:—F1 A(1C2, 2A2A, 3C, 4G, 4Q).

Int. Cl.:—F 04 b 9/10.

COMPLETE SPECIFICATION.

Liquid Pumping Apparatus.

We, RAWDON ENGINEERING AND TOOL CO. LIMITED, a British Company, of Grove Works, London Lane, Rawdon, near Leeds, in the County of York, and ALBERT HINDLE, a British subject, of Mawcroft Cottage, Nether Yeadon, near Leeds, in the County of York, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

This invention relates to liquid pumping apparatus. It is primarily intended for spraying water, emulsions or lubricants used in the processing of textiles, but it has other uses, for example in pumping corrosive or other liquids which are difficult to handle with ordinary pumps.

Known pumps of the reciprocating plunger type for pumping water or liquids with minor lubricating properties have deficiencies in rapid-wearing plungers and gland seals due to absence of proper lubrication. A further drawback occurs where the plunger and valves are above the liquid level, involving a suction lift often necessitating priming means.

It is an object of the present invention to eliminate or reduce these deficiencies by providing an improved construction of pump of the kind embodying a pump-like pulsator unit arranged to transmit through a closed body of oil a succession of pulses to one side of a diaphragm pump the other side of which communicates through non-return valves with the body of liquid to be pumped and with a discharge outlet.

In an apparatus according to this invention and of the kind alone set forth, the pulsator unit is power driven and includes a piston arranged to be reciprocated in a cylinder which is inclined to vertical and horizontal planes and whose lower end communicates through a pulsator tube with a diaphragm pump carried by said tube, said diaphragm pump being arranged to be immersed in the liquid to be pumped and having its delivery side connected by a pipe or other duct to a distribution device having one or more discharge outlets, the washing chamber of said cylinder being fed by gravity with oil from a reservoir in a space above the piston via a priming duct which is exposed by the piston during each strobe and which also serves to keep the space between the piston and the diaphragm full, and a pressure-relief valve being provided between the piston and the diaphragm pump to ensure, with the aid of said priming duct, the required pressure of oil on the diaphragm pump.

In order that the invention may be fully and clearly comprehended, the same will now be described with reference to the accompanying drawings which illustrate by way of example one embodiment of the invention and wherein:—

Figure 1 is a perspective view of the whole apparatus;

Figure 2 is a sectional elevation, the section being taken mainly through the longitudinal centre of the apparatus;

Figure 3 is a part section taken on the line A—A through the reciprocating piston of the pulsator and its crankcase;

Figure 4 is a section through a distribution block corresponding to the view of this block shown in Figure 2 but to a larger scale;

Figure 5 is a section taken on the line B—B in Figure 4.

In the illustrated form of the apparatus, a tank 1 to hold the liquid to be pumped has secured on it a lid 2 with strengthening ribs 3. This lid forms a platform to carry the pump and its driving means. An electric

[P]

motor 4 drives through a belt 5 a pulley 6 secured on a crankshaft 7 which is journalled in bearings in the sleeve 8 of the crankcase 9 secured by a bracket 10 on the lid 2. The crank 11 is connected by connecting rod 12 to a reciprocating pulsator piston 13 operating in an inclined cylinder 14.

The lower part of the tilted crankcase forms an oil reservoir with a filler plug 15, the oil level being above a priming duct 16 in the cylinder wall so that oil can feed into the cylinder below the piston by gravity when the piston is above the port as it is shown in Figure 2.

The lower end of the cylinder is connected by a relief valve housing 17 to a vertical pulsator tube 18 passing through the lid 2 into the liquid in the tank. Secured to the lower end of this tube is a flange 19 bolted to a valve body 20. Held between the flange and the valve body is a pump diaphragm 21 of synthetic rubber with nylon insertion or of other suitable material, the opposing faces of the flange and valve body being suitably recessed to allow for the predetermined amount of movement of the diaphragm. The space beneath the diaphragm communicates with a non-return suction valve 22 and a non-return delivery valve 23, the latter having a delivery duct 24.

A flexible pipe 25 passing through the lid 2 connects the duct 24 to a distribution block 26 mounted on the crankcase 9 and leads liquid from the tank to two outlets 27, 28 to which can be coupled flexible spray pipes of any desired length. The liquid passes to the outlets 27, 28 via a chamber 29 to be referred to later, and the maximum pressure of this flow is controlled by a spring-pressed regulating valve 30 which is mounted in a chamber 30X and whose opening pressure can be predetermined by adjustment of a regulating screw 31. If valve 30 opens, the excess pumped liquid is returned to the tank through pipe 32.

The operation is as follows. Before starting the pump after initial installation, the crank is rotated so as to fully retract the piston 13 to a position (see Figure 2) where the priming duct 16 in the cylinder is uncovered by the piston and oil is allowed to flow down and fill the tube 18 and the whole space between the piston and the diaphragm. This is facilitated by means of a vent plug 33 which is located in the cylinder wall at the highest point and which, when removed, allows the air displaced by the oil to escape. Replacement of the vent plug seals the cylinder and tube, now filled with oil, pressure tight, so that when the crank is rotated it oscillates the piston, displacing the column of oil and the diaphragm in alternating directions with a pulsating action. This displacement of the diaphragm induces a flow of liquid to be pumped through the suction and delivery valves and to be delivered through the flexible pipe 25 to the distribution block and thence to the spray pipes.

A spring loaded oil pressure relief valve 34 is incorporated in the housing 17 so that excess oil pressure generated is allowed to escape back to the reservoir in the crankcase through a portway 35. Preferably there will always be a slight excess to ensure correct operation of the diaphragm pump.

The delivery of liquid to the spray pipes is at a substantially constant pressure, the value of this pressure being set at the desired figure by adjustment of the regulating valve 30. The pressure may fluctuate slightly on either side of a mean value due to the pulsating effect on the diaphragm pump, but this will be substantially evened out during the flow of liquid through the distribution block.

Preferably means are provided, also in the distribution block, to release all pressure in the pumped liquid system the instant the machine to which the spray pipes lead stops, and so to arrest the flow of liquid through the spray pipes.

In the illustrated arrangement this pressure release is achieved by a solenoid-operated cut-off valve. This consists of a ball valve 36 in the chamber 29 in the distribution block, the ball being held on to its seat by pressure of the liquid assisted by a light spring. A main tension spring 37 acting through a pivoted lever 38 and an adjustable actuating plunger 39 is arranged to normally hold the ball off its seat and to allow liquid pumped up pipe 25 to escape back to the tank through duct 29X and pipe 32.

An electric solenoid 40 is provided and electrically connected with the machine. When the machine is working the solenoid is in the "on" position, as shown in Figure 1. This actuates the lever and the plunger, overcoming the main spring 37, and allows the ball valve to seat, so that the pump liquid passes to the spray pipes. When the machine is stopped and the solenoid is automatically de-energised and this allows the main spring to actuate the lever and plunger, pushing the ball off its seat and releasing pressure in the liquid delivery system, the liquid then circulating through pipes 25, 32 until the machine is re-started or the pump is stopped.

If desired, the pump may be stopped simultaneously with the stopping of the machine, the solenoid valve 36 acting immediately to cut off pressure from the spray pipes and prevent further delivery of liquid while the pump is running down.

The piston 13 being inclined down towards the top of tube 18, the space between the piston and the diaphragm is kept filled

with oil (or other suitable fluid) so that the pulsator is self-priming.

It will be noted that the piston 13 does not come into contact with the liquid being pumped so that it can be kept properly lubricated and does not suffer from, nor need be protected from, corrosion by such liquid, whereas the material of the diaphragm can readily be chosen to withstand attack by the pumped liquid.

It is to be understood that the reciprocation of the piston 13 could be produced by any suitable mechanism other than the crank arrangement described above, and this mechanism could in suitable cases be driven by an electric motor either direct-coupled or through reduction gearing, which gearing might be housed in the crankcase 9 and immersed in the oil in the reservoir.

WHAT WE CLAIM IS:—

1. Apparatus of the type herein set forth for pumping a liquid under substantially constant pressure from a reservoir of such liquid, wherein the pulsator unit is power driven and includes a piston arranged to be reciprocated in a cylinder which is inclined to vertical and horizontal planes and whose lower end communicates through a pulsator tube with a diaphragm pump carried by said tube, said diaphragm pump being arranged to be immersed in the liquid to be pumped and having its delivery side connected by a pipe or other duct to a distribution device having one or more discharge outlets, the working chamber of said cylinder being fed by gravity with oil from a reservoir in a space above the piston via a priming duct which is exposed by the piston during each stroke and which also serves to keep the space between the piston and the diaphragm full, and a pressure-relief valve being provided between the piston and the diaphragm pump to ensure, with the aid of said priming duct, the required pressure of oil on the diaphragm pump.

2. Apparatus according to Claim 1, wherein said distribution device includes means for automatically releasing all pressure in the pumped liquid system when the demand for such liquid from a machine or installation to which the apparatus is coupled ceases.

3. Apparatus according to Claim 2, wherein said automatic means includes a valve in said distribution device interposed between said system and a return pipe leading back into the liquid reservoir, a spring-pressed lever and plunger arranged to hold said valve normally open, and an electric solenoid device arranged to actuate said lever to close said valve and hold it closed as long as the demand for the pumped liquid exists.

4. Apparatus for pumping liquid under substantially constant pressure from a reservoir of such liquid, constructed and arranged as herein described with reference to and as illustrated in the accompanying drawings.

JOHN E. WALSH & CO.
Chartered Patent Agents,
9, Park Place,
Leeds, 1.

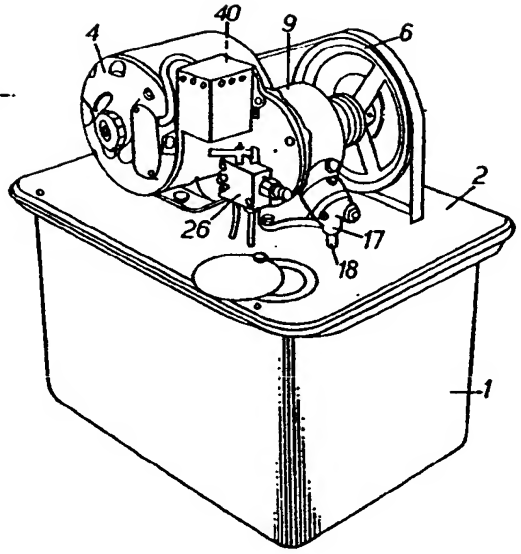
Printed for Her Majesty's Stationery Office by Burgess & Son (Abingdon), Ltd.—1969.
Published at The Patent Office, 25 Southampton Buildings, London, W.C.2,
from which copies may be obtained.

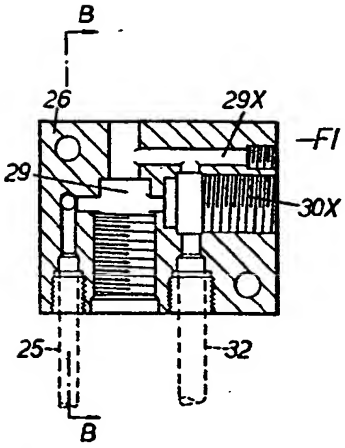
1145752 COMPLETE SPECIFICATION

2 SHEETS *This drawing is a reproduction of the Original on a reduced scale*

Sheet 1

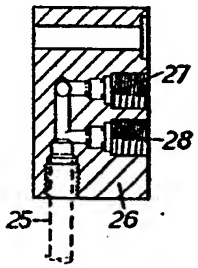
-FIG.1.-

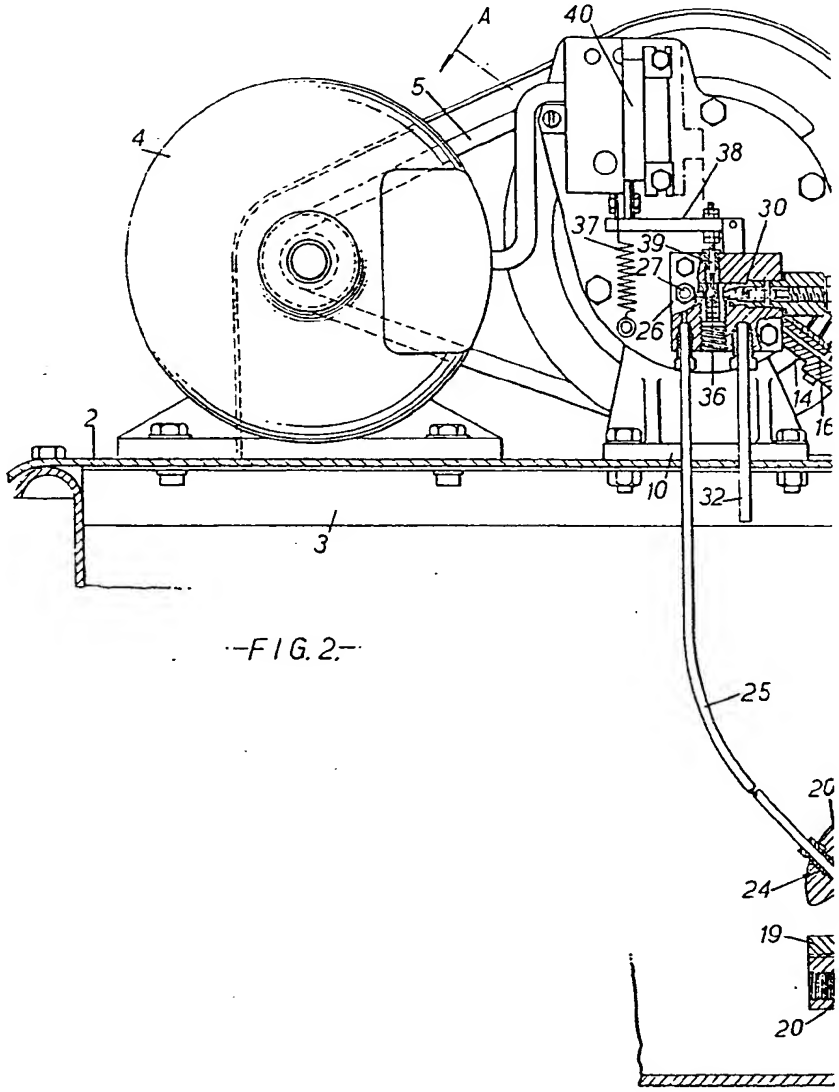




-FIG.4.-

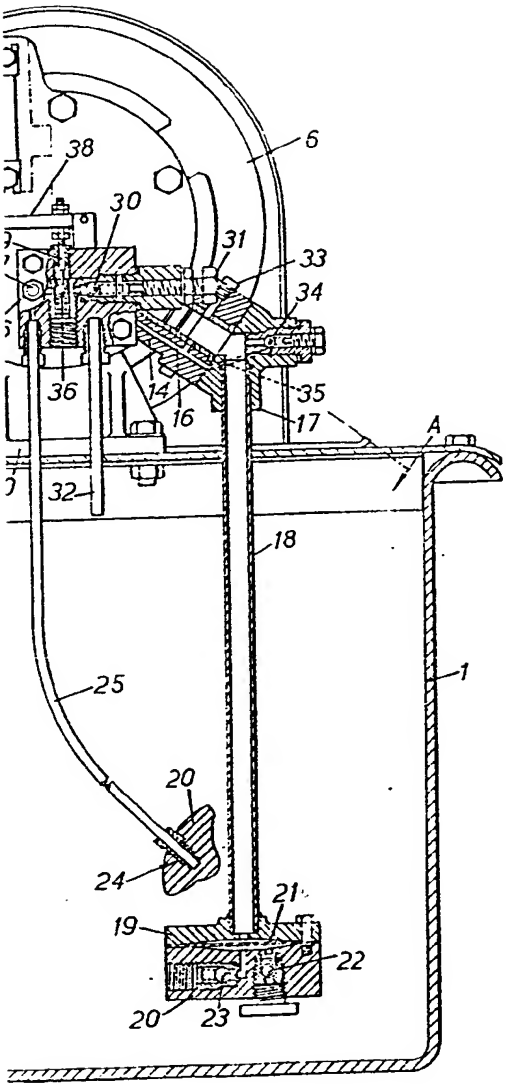
-FIG.5.-

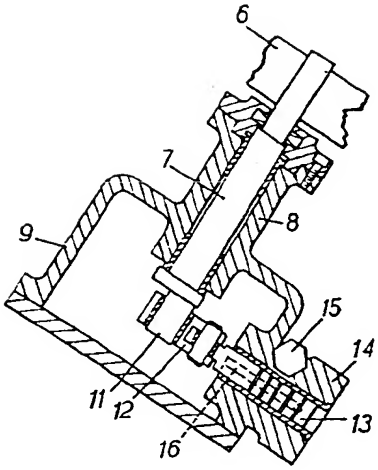




-FIG. 2.-

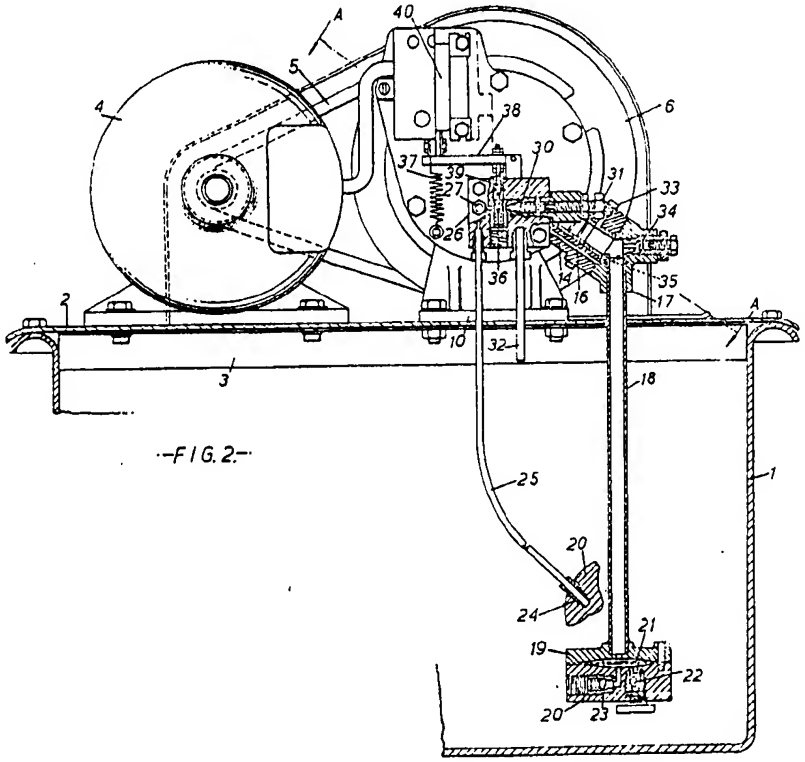
1145752 COMPLETE SPECIFICATION
2 SHEETS *This drawing is a reproduction of the Original on a reduced scale*
Sheet 2



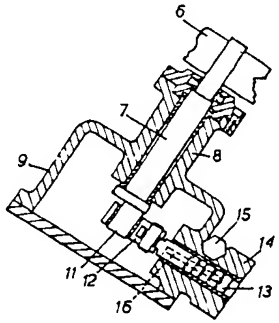


—FIG. 3.—

1145752 COMPLETE SPECIFICATION
2 SHEETS This drawing is a reproduction of the Original on a reduced scale
Sheet 2



-FIG. 2.-



-FIG. 3.-